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BIOLOGICAL HERESIES.

The Nature and Origin of Living Matter. By Dr. H. Charlton Bastian, F.R.S. Pp. 344; with 245 illustrations from photomicrographs. (London: T. Fisher Unwin, 1905.) Price 12*s.* 6*d.* net.

DR. H. CHARLTON BASTIAN re-expounds his well known biological heresies with a vigour and industry worthy of a better cause. The first heresy is that "*archebiosis*" is a present occurrence, that is, that living organisms may here and now arise from non-living materials. What seems to most biologists so difficult to conceive with any concreteness, that their evolutionist faith is strained a little to believe it may have occurred *once* long ago, may be seen occurring any day in this veteran experimenter's laboratory. What Pasteur looked out for in vain for a score of years has been revealed to Bastian's persistent patience. The second heresy is that "*heterogenesis*" is not infrequent, that is, that a living creature may give rise to alien offspring, to organisms quite different from itself, it may be belonging to a different class altogether. Against the fact of the persistence or continuity of hereditary resemblance we are accustomed to balance the fact of variation; but now we are asked to make room for what is more than the most convinced believer in mutations or transilience ever dreamed of, namely, such facts of heterogenesis as the production of infusorians from a rotifer's egg. Our convictions as to the specific plasmic architecture of different forms of life, our difficulty in imagining how chlorophyll corpuscles can become a swarm of sun-animalcules, must be corrected, like other prejudices, by facing the facts. To ignore these is the worst form of *ignorantia elenchi* of which scientific students can be guilty. If nature's method includes the hop, step, and leap phenomena, which this book describes at great length, what can excuse the blindness of those who persist that evolution is like a snail's continuous crawl?

To see what Dr. Bastian interprets as archebiosis, we are recommended to take an infusion of turnip or fresh beef, to filter this through two layers of the finest Swedish paper, to let a drop fall on a cleaned microscope slip, to put a cover-glass on, to remove excess of fluid with blotting-paper, to allow one or more air-bubbles to remain in the film, to seal up with melted paraffin wax, to fix upon a clear space free from particles near an air-bubble, to incubate at blood-heat for two or three hours, and to await events. The expected happens—multitudes of living particles appear. How can we account for their origin? Three hypotheses present themselves, (*a*) that they have arisen through the reproductive multiplication of one or more germs that had escaped observation in the film; (*b*) that they have developed from a multitude of diffusely disseminated *invisible* germs; or (*c*) that they have been produced *de novo* in the fluid by a process of archebiosis. The author argues that the third interpretation is the true one. One of the arguments is based on the uniformity of nature:—

"To assume, as the great majority of Evolutionists do, that Archebiosis, or the natural origin of living matter, took place once only in the remote past and that it has not been repeated, or if repeated in past times, that it no longer goes on, is to look upon this process as a kind of natural miracle, and to postulate a break in continuity which ought only to be possible in the face of overwhelming evidence of its reality. This latter is, however, as I contend, altogether absent to anything like an adequate extent."

This kind of argument applied to other great events in evolution has the advantage of fostering an expectant attitude. Nature may be repeating herself oftener than we think.

Many of us have made flask experiments with super-heated organic fluids, which remained sterile for years without any hint of archebiosis; but, of course, these experiments only prove that living organisms do not arise under these severe conditions. We must give archebiosis a chance, and unluckily that chance usually means either an open door to infection or imperfect sterilisation. But the surer work we make with sterilisation, the greater likelihood is there of our destroying what Dr. Bastian calls the *germinality of the fluids*. When organisms do *not* appear in the sterilised medium the sceptical experimenter says "Biogenesis is confirmed," whereas he ought to say "Unluckily, I have destroyed the germinality of good archebiotic material." When organisms *do* appear in the sterilised medium the sceptical experimenter says "What an ass I am!" but if he were not so slow of heart to believe, he should say "Archebiosis for ever."

As to the original archebiosis in free nature, the author makes the suggestion that nitrate of ammonia (or nitrite?), which is formed in the atmosphere in thunderstorms and brought down by the thunder shower, may have played an important part in the mixture of ingredients in which protoplasm was first synthesised.

Dr. Bastian's patient experiments on heterogenesis raise, as it seems to us, some interesting questions concerning the variability of minute organisms, the phases in the life-history of many forms which are very inadequately known, the occurrence of "latent germs" in the interior of healthy fruits and animal organs, and so on. But we are too bigoted to believe that diatoms can be produced by the transformation of the cells of an unrelated alga, that anabena or actinophrys or amœbæ can arise from chlorophyll corpuscles, that the eggs of a fly may be transformed into infusorians, or that several different kinds of ciliata may arise from the eggs of one and the same rotifer. While all this is incredible to us because it is magical and unmeaning—incongruous with our experience of nature's workings—the difficulty is to interpret what Dr. Bastian saw and photographed. We venture the suggestion that in some of the egg-experiments he may have been on the track of ovivorous parasites such as are known to infest the eggs of some aquatic insects.

While we must stand aloof from Dr. Bastian's heresies, we cannot but admire his dogged support of what seems to us a lost cause. It is something to stand *unus contra mundum* with no loss of courage or of good humour. We also sympathise with some of the positions which the author maintains in the introductory part of his book, *e.g.* as to the innate or intrinsic variability of living matter, and as to the importance of discontinuous variations or mutations. There is also much vigorous criticism of Weismann's last volume, "The Evolution Theory," and a defence of Spencer's concept of "physiological units" as against Weismann's "determinants." But when, in regard to the transmission of modifications, Dr. Bastian says that "Weismann frankly admits the whole point in dispute—namely, that *acquired characters can be, and are, frequently inherited,*" we must express our surprise at what seems to us an extraordinary misunderstanding. J. A. T.

A STANDARD TREATISE ON PHYSICS.

Lehrbuch der Physik. By O. D. Chwolson. Vol. iii. Translated into German by E. Berg. Pp. xi+988; illustrated. (Brunswick: Vieweg und Sohn, 1905.) Price 16 marks.

Traité de Physique. By O. D. Chwolson. Translated from the Russian and German editions into French by E. Davaux, with Notes on Theoretical Physics by MM. E. and F. Cosserat. Vol. i., part i., pp. xiii+407; vol. ii., part i., pp. vii+202. (Paris: A Hermann, 1906.) Price 16 francs and 6 francs respectively.

THE first two volumes of this important translation from Russian into German have already been noticed in these columns. The present volume embraces the science of heat, including thermodynamics. The treatment throughout is most admirable both for accuracy and lucidity, and the treatise may be expected to become generally known in this more accessible shape. Each chapter is followed by copious references to original sources of information; these are divided into sections numbered according to the parts of the text to which they relate; they constitute a valuable summary of the most important memoirs, especially as they include quite recent work as well as the earlier work which formed the foundation of the science of heat. The illustrations are excellently done.

Besides the phenomena which are usually described in a treatise on physics (thermometry, expansion, thermal capacity, laws of cooling, conductivity, general thermodynamics, and equations of state), chapters are to be found here on thermochemical investigations and the theory of solutions, including the phase rule. These are not in any way skimped. An outline of everything that is worth knowing seems to be included. The matter is not served up in a haphazard manner; but the relative value of different investigations is well brought out by the amounts of space which are devoted to them. The book is a happy mixture of theory and practice. For example, while a delightfully clear explanation is given of the meaning of the various partial differential coefficients which arise in theoretical thermodynamics, there is also given one of the very few existing correct accounts of the implication of the Joule-Thomson experiment.

The methods of Planck are followed in connection with thermodynamics. The play of entropy in irreversible transformations is made very clear; a student, by its perusal, could hardly fail to get nearer to a true conception of the nature of such processes.

The results of an investigation are not merely summed up in a formula; in most cases a table of experimental data upon which the formula is based is also provided. This, of course, is as it should be, for it puts the reader at once in touch with the actual experiment, and differentiates the volume from a mere collection of physical tables.

Altogether, we do not hesitate to say that the three volumes form as satisfactory a treatise on the part of physics to which they relate as we have ever met with. They are to be followed by a fourth volume on electricity and magnetism.

In the translation into French both the Russian and German editions are made use of, while additional notes on theoretical physics are added by MM. E. and F. Cosserat, the former of whom is a professor in the University of Toulouse. This also will appear in four volumes; the present instalment consists of parts of the first two. The additional notes will be kept quite distinct from the main text. One such note (consisting of 37 pages) now appears on the dynamics of a particle and of a rigid body. This is an attempt to re-state the principles of mechanics in such a way as to remove the difficulties pointed out by M. Poincaré in the application of mechanical principles to natural phenomena. These difficulties arise, according to Poincaré, from a too faithful application to all phenomena of the theory of the astronomical universe. The system of mechanics expounded is in general based on energetics, but a wider form than usual is given to this principle. It is impossible to criticise the theory presented until the remaining notes bearing on it have appeared.

With regard to the French edition in general we are very well pleased, and we look forward to its completion, for there are many to whom it will prove more welcome than its German equivalent. The treatise bids fair to prove itself the leading text-book of physics for general use.

CLIMBS IN WESTERN CANADA.

In the Heart of the Canadian Rockies. By James Outram. Pp. 466; with maps and 46 illustrations. (New York: The Macmillan Company; London: Macmillan and Co., Ltd., 1905.) Price 12*s.* 6*d.* net.

IN the "Apology" with which this volume is prefaced, the author tells how he went to the mountains during a part of three summers to recuperate from mental overstrain, and states that he has been hampered by the same disability in preparing his book. Nevertheless, he has succeeded in producing a useful piece of work, which brings together an account of all that has been accomplished in the